جامعة بيرزيت

BIRZEIT UNIVERSITY

COMP2332

ELECTRONIC HEALTH ENTERPRISE BUSINESS PROCESS MODELLING

Computer Science Department

EYE CLINIC CASE STUDY

E-CARE G4

INSTRUCTOR: Adel Taweel.

2019/2020 1ST SEMSETER

Contents

Chapter 1

1.1 Group Name: Group Number

E-Care: G4

1.2. names, university Student IDs and Pictures of the members of the group & Role of each member.

Lana Elayyan

1180839

Model Designer

Dania Alqam

1180950

Business Modeller

Bisan El Gool

1181116

Project Manager

Razan Yaseen

1182226

Secretary

Raneem Mansour

1181706

Business Modeller

Yazan Issa

1183066

Model Designer

1.3. Project management strategy

Group meetings were done over zoom weekly, every member would show what have they done with their assigned part and would show the progress in their work. Decisions were made as a group by voting.

1.4. Project manager report

1.4.2. the barriers or challenges faced in managing the project

Because of COVID-19 reaching to the clinic to collect information was hard, we had some issues with communicating because every group member has a different schedule, so it was hard to find a time that suites everyone to meet!

1.4.3. his/her opinion on how s/he evaluates the success of their project.

It went pretty well! The first assignment was not great, we forgot to add the critical analysis but we added it in this assignment. The distribution of the work was not distributed equally, but every member had the option to choose which part of the project they want to do. And if the result was not good, they were given another part and their previous part would be also given to someone else. overall, I think we did very well in this assignment.

asks:

- case study description in assignment 1.
- wrote and documented first assignment report.
- helped in the presentation.
- contributed in drawing the AS-IS model.
- contributed in analyzing the as-is model.
- helped identify inefficiencies in the processes.
- identified actual root causes, causing inefficiencies in activities.
- contributed in finding bottlenecks and writing if scenarios.
- drew the TO-BE model.
- identified what improvements could be made to the AS-IS model to develop the to be model.
- wrote the description About how the new TO-BE model addresses the identified inefficiencies and how it solved them.
- Analyzed the “TO-BE” model, using the scalability of the model testing using what-if scenarios, using the same scenarios we have used before.
- wrote and documented the report for assignment 2.
- modified the AS-IS and TO-BE model according to the comments the professor gave during our presentation (project discussion).

1.4.1. the work done by each group member

Task	Bisan El Gool	Razan Yaseen	Dania Alqam	Lana Elayyan	Raneem Mansour	Yazan Zayed
Visited the clinic			✔			
Report documentation	✔					
EPC		✔			✔	
ARIS			✔	✔		✔
Presentation			✔	✔		✔
ASSIGNEMENT 2						
Modified EPC	✔	✔				✔
AS IS model		✔	✔		✔	
Drawn AS IS	✔	✔	✔			
Primary, support and management activities.		✔	✔			
identify business process inefficiencies	✔			✔		✔
root-cause analysis	✔					
what-if scenarios	✔	✔	✔	✔	✔	✔
TO BE model	✔	✔	✔			
Draw TO-BE model	✔					
Analysis of TO-BE	✔	✔	✔			
What if scenarios	✔	✔	✔	✔	✔	✔
Final presentation		✔	✔	✔		
Report documentation	✔					

1.5. Group members report

Razan Yaseen

In my opinion this project was a great opportunity to expand my knowledge in this field. It was a chance to work with an excellent team. I am satisfied with all the work we have done and proud of the effort we have invested in this project.

Following are the tasks I have played a main role in:

- _ The first version of the EPC model
- _ The final EPC model
- _Draw the AS IS BPMN
- _Contributed in the analysis of the AS IS BPMN
- _Contributed in the drawing of the To-Be model and the analysis of it
- _Contributed in preparing the presentation
- _Write the primary activities, support and management activities
- _Contributed in writing what if scenarios

Dania Alqam:

I think the work between the group members was collaborative. We worked as one team, and cooperated to achieve required tasks. We understood the concepts of business process model.

My tasks:

- Visited the clinic.
- Drew ARIS model.
- Prepared presentation1.
- Drew the AS-IS BPMN.
- Participated in the analysis of the AS IS BPMN.
- Participated in the drawing of the To-Be model and the analysis of it.
- Prepared the presentation2.
- Identified core, support and management activities.
- Participated in writing what if scenarios.
- Modified the EPC model according to the comments given in the presentation.

Raneem Mansour:

It was a really unique experience, as we acquired several skills, including contacting with the real World, searching for problems around us, critical analysis, and searching for logical solutions through the optimal use of time, cost and quality. In addition, and due to the current situation, we have learned about new tools to communicate so that we, as a team, can work together despite the technical difficulties and difficulties we faced in communicating sometimes due to the incompatibility in our study schedule times.

Task:

designed EPC model and participated in discussion and analysis of the project, presenting problems, what if scenario's and finding solutions.

Lana Elayyan, 1180839

Opinion: We have learned a lot while visiting the clinic. It was hard to get in touch with this clinic and the group members because the corona situation, I think the work between the group member was collaborative(zoom meeting). We worked as one team, shared ideas and cooperated to achieve required tasks. I think this project was very successful and we were able to locate the bottlenecks in their business process and suggest improvements. We understood the concepts of business process and we worked as expected from us. We hope to be professional in business process mode in the future.

My Tasks:

- Contributed in writing the case study description.
- Contributed in drawing the ARIS mode.
- Participate in identifying bottlenecks.
- Participate in identifying inefficiencies in the process.
- Prepare the first presentation.
- Participated in the analysis of the TO-BE (what if scenario).
- Identified core, support and management activities.
- Identified the process inefficiencies in the primary activities and possible errors in support activities.
- Prepared the final presentation.

Yazan Zayed

I see that the project was completed perfectly. The project that we did is definitely a successful project that covers all the tasks required, from an explanation of the clinic system that we visited and analyzing this system to finding some problems that this system may go through and then finding solutions to these problems and their reflection on the models and diagrams we are required to complete.

As I mentioned above, we were working as a unified team. There was definitely a division of the tasks required, but this does not mean that the team members were not helping each other.

Tasks:

- I participated in the drawing of The ARIS Model
- participated in the analysis of activities and system in the identification business process inefficiencies in the primary activities, and possible inefficiencies, errors or unnecessary support activities, and if any inefficiencies in management activities.
- And in finding solutions to these problems and inefficiencies activities in order to present them in
- the (To Be model).
- Contributed in writing the if scenarios.
- Helped in preparing the presentation.
- Contributed in modifying the EPC model in assignment 2.

Chapter 2- Case Study: Description

2.1. The description of your case study, from your assignment-1

Ophthalmology is a branch of medicine and surgery which deals with the diagnosis and treatment of eye disorders. An ophthalmologist is a specialist in ophthalmology. Ophthalmologists are allowed to use medications to treat eye diseases, implement laser therapy, and perform surgery when needed. Ophthalmologists may participate in academic research on the diagnosis and treatment for eye disorders.

Although most people may think that eye doctors do nothing but deal with appointments of people needing glasses and contacts, they actually do a whole lot more. Even general eye evaluations entail examining the health of the eye and looking for any potential concerns. Take for example, someone needing contacts for the first time; in addition to the evaluation, the doctor will need to provide additional services. This can include training on how to insert and remove contacts and providing general care information as well as diagnosing and solving any fit problems. They also need to know which type of contacts would be best for their patient as there are many varieties, including multifocal, soft disposable, keratoconus, rigid gas permeable, monovision and irregular-shaped lenses for individuals with corneas that have suffered disease or surgery.

When the patient visits the clinic for an eye exam, the patient has to reserve an appointment first, after the patient arrives at the clinic, they will pay the fees at the reception before they go to the doctor's office. If the patient has medical and/or vision coverage, the receptionist will check their plan documents to see if these additional exams and tests are covered, If not the patient will pays in cash. Then the receptionist will check if it's the patient's first time or if it's a follow up, if it's their first time a record will be created for the patient, after that the patient will stay at the waiting room until the doctor calls them in. At the beginning of the eye exam, the eye doctor will ask for the patient's medical history, if they have been experiencing any vision problems and the reason of the visit. If they currently have glasses or contacts, they should bring them to the exam so the eye doctor can see if they need prescription changes, and then the doctor will redirect the patient to optical to get the prescribed lenses.

During the eye exam, the eye doctor can perform a number of different tests such as a visual acuity test which examines how well you can see with each eye. The doctor may ask the patient to cover one eye at a time while identifying symbols. Typically, these symbols are different sized letters or numbers on a chart that's displayed at a distance from the patient. Based on the results, the doctor can determine how well the patient can see at a distance.

The doctor may also perform a refraction eye exam which helps the doctor figure out what prescription is needed for glasses or contact lenses. To test this, the doctor may have the patient look into a machine that displays lenses of different strengths. By switching the lens in front of each eye while they read letters and numbers on a chart, the doctor can figure out which lens is best for them. This refraction test also helps the doctor to determine if the patient need a different strength lens in each eye. Doctor will check the patient's results and give a diagnosis, further tests may be done if needed.

If the doctor finds any problems during a comprehensive eye exam (a series of routine vision tests), they may ask the patient to come back for a follow-up eye exam so they can run additional vision tests. This is often done once a year or once every two years.

In some cases, like optic neuritis (when the optic nerve becomes inflamed) or in case of cataract (an opacification of the lens of the eye which leads to a decrease in vision) the doctor will redirect the patient to the hospital for further treatment.

Other provided services include:

• Examine eyes for health and vision problems

• Diagnose and treat eye disease

• Detect and identify general health problems manifested in the eye (i.e. diabetes, high blood pressure, sickle cell anemia, etc.)

• Provide pre-and post-operative care for pathologies and trauma

• Remove foreign bodies from eyes

• Prescribe glasses or other devices for specialized vision needs such as hunting, computer work, playing piano, etc.

• Provide rehabilitative services for victims of head injuries with impaired vision

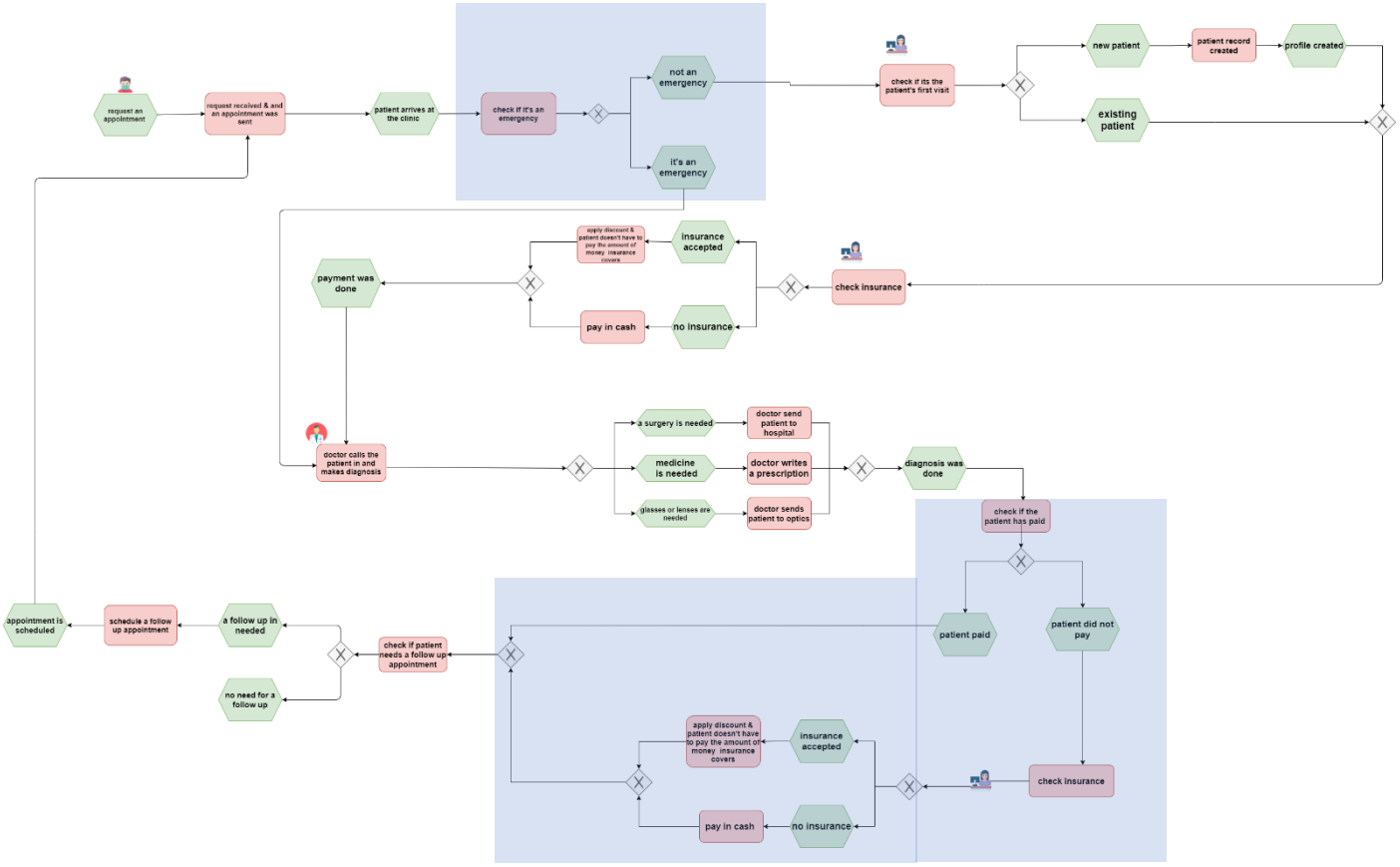
• Evaluate eye coordination for reading and provide vision therapy to improve academic performance

• Work with schools and community groups on vision screening, career days, programs on eye care, etc.

After the diagnosis is done, the patient will leave the doctor's office.

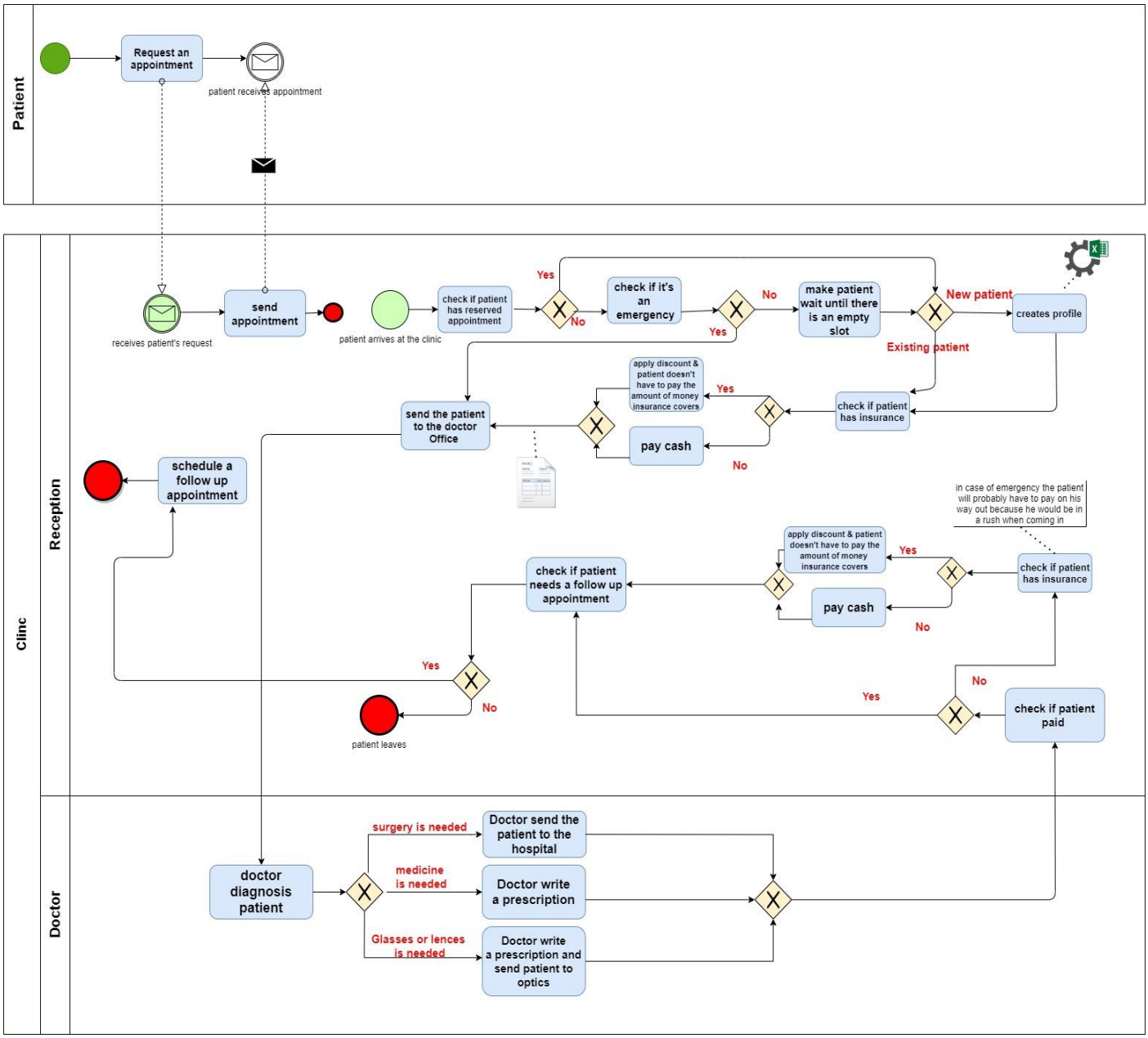
2.2. EPC Model – from assignment-1.

An EPC diagram, short for event-driven process chain diagram, is a flowchart-based diagram that can be used for resource planning and identifying possible improvements of a business process. Below is an EPC diagram for an eye clinic:



Chapter 3- Case Study: AS-IS BPMN and Business Process Analysis

3.1. The AS-IS BPMN model



3.2. The business process analysis of the AS-IS model.

3.2.1. The identified Primary (core) activities, support and management activities

Primary activities:

- The doctor examining the patient and giving diagnosis.
- Receptionist checking if the patient has paid.

Support activities:

- The Secretary scheduling patients' appointments.
- Secretary handling Payments and checking the patient's health insurance.
- Secretary handling calls and messages.
- Secretary checking if the patient has a prescheduled appointment and if it's an emergency case.

Management activities:

The manager is the doctor:

- Employee recruitment.
- Checking and handling clinic incomes.

The clinic in our case study is a small clinic with only one doctor, so there aren't many process, but after creating the to be model there were more process.

3.2.2. business process inefficiencies in the primary activities, and possible inefficiencies, errors or unnecessary support activities, and if any inefficiencies in management activities and actual root causes, causing inefficiencies in activities & critical analysis.

Improving the flow of patients through the clinic is about making their journey easier while making the best use of the doctor's time and the resources in the eye clinic. It can be done by eliminating unnecessary steps and processes, giving more time to focus on patients and on providing a good – and friendly -service. Better patient flow reduces waste and makes more efficient use of time and human resources, which in turn reduces costs, attracts more patients, and improves cost recovery.

Tracking patient flow provide a tremendous amount of information about how efficiently patients progress through each stage of their office visit. We kept record of the time the patient spent at each station or process, this would help us know where the problem is and which station takes the longest, and find solutions to make the procedure faster. Here are some of the stations the patient goes through on his journey and the time taken at each station (we too the average time for 7 patients): Cycle time measurement helps reveal bottlenecks and waste within a process. To assess cycle time, we followed each step of the patient's visit to the clinic and measure the amount of time currently required to complete it. An example of the cycle time for an office visit is shown here. Note that at least half of the time spent would be considered non-value-added.

- Time the receptionist takes to check the patient's insurance:

  For a new patient: **7:24** mins (including the time taken to create their profile).

  Already exists patient: **5:14** mins

- Retrieval of medical records (the doctor asking about the patient's medical history and the reason of the visit): **2:13** mins
- Treatment: **7-10** mins

We also asked the doctor some questions to help us understand what causes inefficiencies in the process, and to understand where most problems occur to find prober solutions for them.

- How many patients are seen on a daily basis? 10-15
- How many patients are early or late for appointments? 3-5
- How many patients do not show up for appointments? 1-2
- How long do patients have to wait in the clinic for appointment delays? Approximately 15-30 mins
- Does gathering patient information add to appointment delays? Yes, sometimes.
- Do you allow time in your days for emergency appointments? No didn't consider it.
- Are there certain days of the week when bottlenecks occur more often? Sat, thu, sun
- At what days do most emergency cases occur? Usually after the weekends end so on Sundays & Saturdays.

So, from the previous information we can see that the patient **check-in processes** is a major cause of bottlenecks. Before even seeing the doctor, patients may get held up filling out forms with front office staff and giving the receptionist their insurance information takes a very long time which would leave the patient frustrated and unsatisfied. Another problem is that the **clinic gets extremely busy at certain days** or times of the day compared to other days, which can be overwhelming and exhausting for the staff, and this will result in not giving the best medical attention to customers and will lead to the staff not giving their maximum effort while examining or treating the patients!

No-shows occur, when a patient fails to attend a scheduled appointment with no prior notification to the healthcare provider. They are missed healthcare utilized time slots and resources that can negatively affect the utilization of space and human resources. Further, they can affect the patient's health condition due to the delay in diagnosis or treatment. Prospective patients can also be impacted and less satisfied due to their inability of scheduling timely appointments. Furthermore, generated revenue also decreases due to the reduction in the system's operational efficiency. For instance, in a recent study for a big hospital, it was estimated that 67,000 no-shows can cost the healthcare system approximately $7 million.

However, through patient records, some patterns can be developed to enhance future prediction for no-shows. For instance, earlier studies showed that patient's past no-show record is a powerful alert that can be used to predict patients who will most likely miss their next appointment.

Forgetting about the appointment, patient scheduling conflicts and miscommunication were found to be the most common causes of patient no-shows or showing up late in various healthcare settings. Besides, no-show of first-time visiting patients could be due to the resolution of transportation barriers because the patient didn't know where the clinic is exactly. Additional causes include the wrong beliefs of the patient about the disease or the test, long waiting time between the actual and scheduled appointment, insurance coverage, and transportation difficulties. examinations for less serious conditions had high rates of no-shows since patients believe that postponing tests would be harmless.

Another inefficiency causing problem is that the clinic doesn't have a policy for dealing with **emergency** cases, when an emergency case occurs it means that the patient needs immediate medical care and should go to the doctor's office directly without reserving an appointment, this would probably miss up the clinic's schedule and could affect other appointments and cause many delays. Even if it wasn't an emergency and the patient comes with **no pre-scheduled appointment,** then they will have to wait until there is an empty slot or until the doctor has no appointments to get their treatment, or can come back another day after scheduling an appointment, which is not very practical, inefficient and time wasting for the patient since s/he would probably come all the way to the clinic for nothing or just waste their time their until there is an empty slot.

Patients' information and appointments are recorded on excel, **Excel** is not reliable, because anyone could modify or change the information and the appointments schedule.

In case the **doctor or provider is absent or calls in sick,** the followed protocol is to only hang a sign at the front door to inform the patients visiting the clinic on this day, this is a horrible way to tell patients, because they came all the to the clinic just to find out that the doctor isn't there! The receptionist could call all patients to tell them that the doctor won't be available but this is a very costly process and could take a really long time since the calls or message have to be done manually and are not automated.

3.2.3. Analyze the AS-IS model, further by identifying its bottlenecks using what-if scenarios

- **What if the number of patients who visited the clinic in a day exceeds 15 patients?**

  which can be overwhelming and exhausting for the staff, and this will result in not giving the best medical attention to customers and will lead to the staff not giving their maximum effort while examining or treating the patients!

- **What if the patient is late to their appointment or didn't show up?**

  They are missed healthcare utilized time slots and resources that can negatively affect the utilization of space and human resources. Further, they can affect the patient's health condition due to the delay in diagnosis or treatment. Prospective patients can also be impacted and less satisfied due to their inability of scheduling timely appointments. Furthermore, generated revenue also decreases due to the reduction in the system's operational efficiency.

- **What if a Patient comes with no pre-scheduled appointment?**

  they will have to wait until there is an empty slot or until the doctor has no appointments, to get their treatment or can come back another day after scheduling an appointment which is not very practical, inefficient and time wasting for the patient since s/he would probably come all the way to the clinic for nothing or just waste their time their until there is an empty slot.

- **What if an emergency case comes in?**

  when an emergency case occurs it means that the patient needs immediate medical care and should go to the doctor's office directly without reserving an appointment, this would probably miss up the clinic's schedule and could affect other appointments and cause many delays.

- **What if doctor absent?**

  followed protocol is to only hang a sign at the front door to inform the patients visiting the clinic on this day, this is a horrible way to tell patients, because they came all the to the clinic just to find out that the doctor isn't there! The receptionist could call all patients to tell them that the doctor won't be available but this is a very costly process and could take a really long time since the calls or message have to be done manually and are not automated.

- **What if patient wants to cancel their appointment?**

  Patient last minute cancellations is a money and resource wasting fact of life for medical practices. There are some practical steps that practices can take to keep them to minimize them.

Our proposed TO-BE model shows the solution to all of the above scenarios, and the solutions are explained in detail in the analysis of the TO-BE model.

Chapter 4- Case Study: TO-BE BPMN Model

4.1. The proposed changes, improvements to the AS-IS model based on the analysis and how the new TO-BE model addresses the identified inefficiencies.

Since the **check in process** takes a lot of time, it could be improved by verifying the patient's personal and insurance information over the phone when they call to schedule an appointment, instead of when they check in to their visit. Or a better solution is to use a secure online portal or a **website** for the clinic where patients can fill out required forms ahead of time. forms will be simple and focused to help patients complete them quicker. Forms will include questions about the patient's medical history and general information, it will also include a precise description of the directions to the clinic's address, this will cut down on new patients arriving late or not arriving at all because they got lost trying to find the clinic. After seeing the doctor, patients may need to schedule a follow up visit, diagnostic testing, and/or be referred to another doctor or the hospital for special care. So, in case the patient needs a follow up appointment the receptionist will check with them and will appoint the first empty slot or any slot that works with the patient, and the patient can change the time anytime they want by visiting the clinic's website and signing into their own account, also the patient can update or modify their information anytime from their profile on the website. Simplifying these processes not only frees up staff time and facilitates necessary care, it enables patients to check in easier and leave quicker. Note: reserving an appointment by calling the clinic is still an option (eve though online reserving is much easier) because elderly people may find it hard to deal with websites or online reservation.

When the patient arrives at the clinic, the receptionist will check if the patient has a **reserved appointment, if they don't**, the receptionist will send them to the doctor office only if it's an **emergency**. if not, the receptionist will check if there are no appointments scheduled at the time of the patient's arrival, if there is an empty slot the patient will be sent to the doctor's office, but if there was no empty slots the patient can check in with the receptionist to book an appointment for another time, or the patient can schedule one themselves using the clinic website, or wait at the clinic until there is a -same day add- appointment in the clinic's schedule (this is explained below).

According to the information we obtained from the clinic, most **emergency** cases occur after the weekends (most accidents happen on weekends). So, a solution we gave to decrease delays in appointments after emergencies, was to design the appointment slots on the website in a way to free some time between appointments, by adding a -same day add- between every prescheduled appointment on the days after the weekend (Saturdays and Sundays) and less of those -same day- appointments on other days of the week, See Table.1. so, when an emergency comes in there is a high probability that it will come in in the free time between appointments, even if it comes when there's already a patient in the doctor's office, only one appointment will be delayed then, and the delay will not be long. We did our research and this method was proven to significantly decrease delay in appointments.

To solve the **overcrowded clinic days** situation, we suggested that the clinic allocates certain time slots for glasses or lenses prescription change, procedures, follow-ups, new patients/consults, this way the patients will be distributed over the week and not in one day. Also, there is only 12-16 free slots to reserve on the web according to the work hours of every day, so the doctor will not see more than the maximum number of patients a day, this will result in the staff not getting overwhelmed or stressed out by the huge number of patients, and every patient will be given the best medical care, and the clinic's schedule will not get messy.

In case of **no-show ups** or **late arrivals**, a missed appointment is more than just a missed opportunity. When a patient doesn't show up, it also affects people who could've been treated instead of that patient. People are not ideal and, for one or another reason, they can be **late**. And once a single person is late, everyone else in the queue is forced to take longer that the agreed time. Many reasons could lead to patients not showing up for their appointments or showing up late, **forgetting about the appointment** for example. Human memory can be quite selective when it comes to what we should and shouldn't remember, calling patients to remind them of their appointments creates a lot of administrative work and is time consuming, instead the number of no show up or late patients can be minimized by using an **automated system to text patients** at set intervals (2 days and again 4 hours before deadline) before their appointment. Other reasons for not showing up include **poor medical literacy** — meaning that patients have limited understanding of what's important for their health — so as a solution is that the **website will have some information** about the symptoms of the most occurring diseases, and how important it is to get checked as soon as possible. So, now the clinic has a **specific protocol to follow when a patient is late**, if the patient is more than 5 minutes late to their appointment the receptionist will call to check if they will still make it, if not, the appointment will be canceled and rescheduled for another time (will probably be scheduled as soon as possible but the interval of how long they have to wait for another appointment is determined by how serious their condition is), the patient can change the time of their appointment from their account on the website. If the patient say that they are still coming they are given 5 more minutes, if they don't show up after that their appointment will canceled and scheduled for another time, as mentioned before.

Patient last minute **cancellations** is a money and resource wasting fact of life for medical practices. There are some practical steps that practices can take to keep them to minimize them. The automated reminder is a good way to remind patients of their appointment, 3 days before their deadline patients will be sent an **automated SMS message** that includes the time of their appointment and a warning that if they cancel their appointment after two days of the deadline they will be **fined**, and another message will be sent 2 days before the appointment to inform that they no longer can cancel and if they do they will be fined. And a final message 4 hours before appointment to remind them to come to the clinic on time. Good communication is a key component of patient satisfaction, and automated appointment reminders are one way to improve communication and reduce no-shows, late arrivals and canceled appointments.

Late **cancellations and no-shows** are inevitable. But their negative effects can be mitigated, by sending out a mass automated text to all patients to notify them of availability and have them respond if they'd like to take the open appointment (in case a patient didn't show up or canceled their appointment). Patients on will appreciate the follow-up.

When a **provider is sick or absent** or there is inclement weather, an automated text message can be sent to all of the patient appointments scheduled for that day. This saves office staff a couple hours of phone calls and ensures patients arrive at their appointments on time, or if the doctor or provider will not come at all, it will save patients the drive and time to get to the clinic.

The website is connected to a database so information will not be lost, and the website is secure so no one can change the patient's information or access it except the doctor and the receptionist.

The nature of the healthcare industry and human nature mean there will likely never be that magic, one-size-fits-all schedule that solves all the practice's scheduling issues. Keeping the best practices mentioned above in mind when developing the patient schedules, however, can go a long way in maximizing productivity and minimizing wait times.

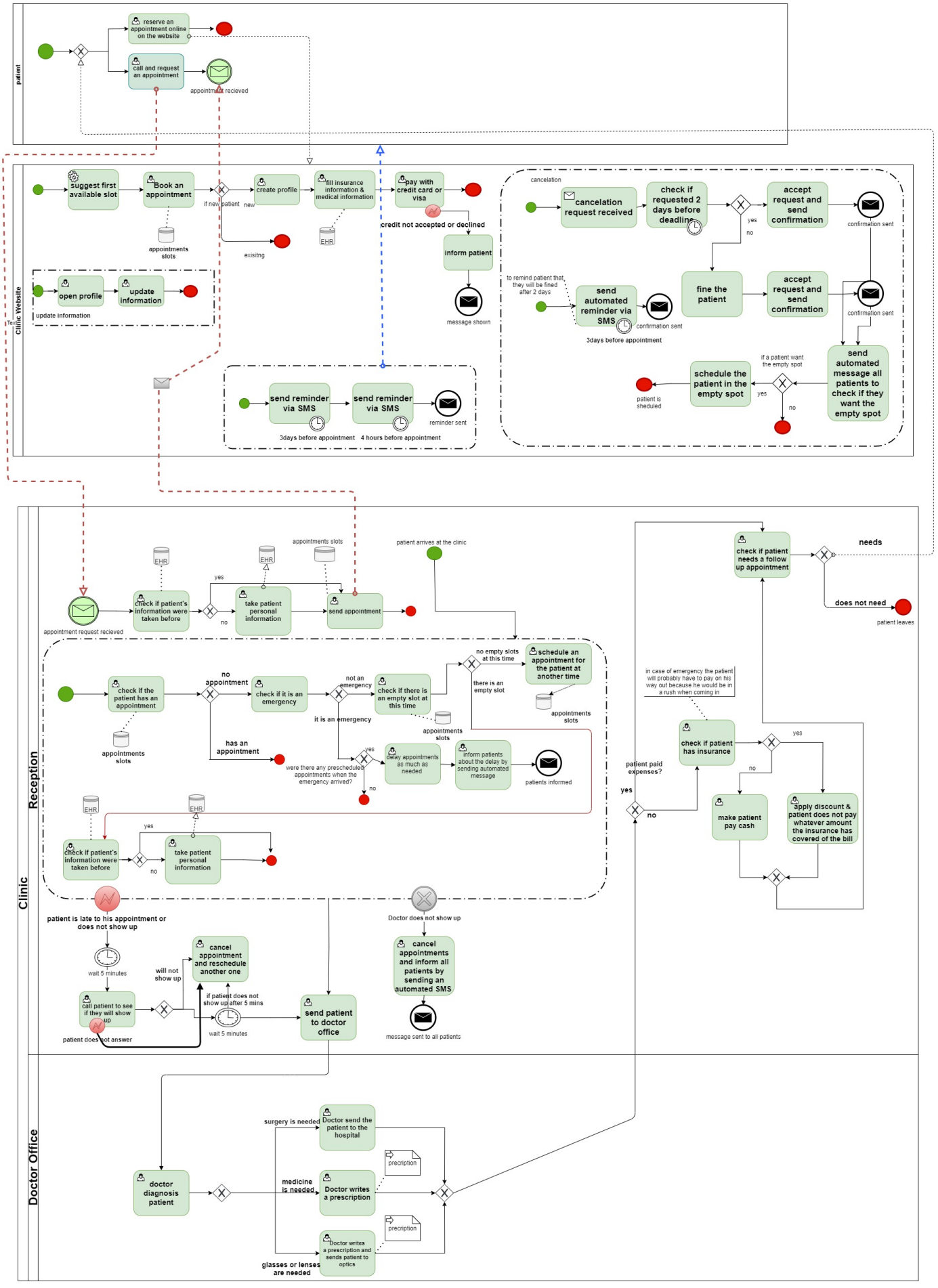
Sunday

7-7:30	**(Prescheduled appointment) Eye check**	**11:15-12:!5**	**(Prescheduled appointment) Cataract procedure**
7:30-8	(Same-day add)	12:15-1:00	(Same-day add)
8-8:30	(Prescheduled appointment) Eye check	1:00-1:30	(Prescheduled appointment)
8:30-9:45	(Same-day add)	1:30-2:00	(lunchbreak)
9:45-10	(Prescheduled appointment) Glasses change of prescription	2:00-2:30	(Same-day add)
10-10:30	(Same-day add)	2:30-3:00	(Same-day add)
10:30-11:00	(Prescheduled appointment)	3:00-3:30	(Prescheduled appointment)
11:00-11:15	(Same-day add)	3:30-4:00	(Same-day add)

Table 1: example for the weekends time slots distribution

4.2. The developed “TO-BE” model.

4.2.1. the proposed “TO-BE” model, showing the changed activities, the new proposed activities, and the new proposed business process flows.



4.2.2. Analyze the "TO-BE" model, using the scalability of the model testing using what-if scenarios, using the same scenarios you have used above in step 3.2.4. in chapter 3.

- **What if the number of patients who visited the clinic in a day exceeds 15 patients?**

  we suggested that the clinic allocates certain time slots for glasses or lenses prescription change, procedures, follow-ups, new patients/consults, this way the patients will be distributed over the week and not in one day. Also, there is only 12-16 free slots to reserve on the web according to the work hours of every day, so the doctor will not see more than the maximum number of patients a day, this will result in the staff not getting overwhelmed or stressed out by the huge number of patients, every patient will be given the best medical care, and the clinic's schedule will not get messy.

- **What if the patient is late to their appointment or didn't show up?**

  The number of no show up or late patients can be minimized by using an automated system to text patients at set intervals (2 days and again 4 hours before deadline) before their appointment + now the clinic has a specific protocol to follow when a patient is late, if the patient is more than 5 minutes late to their appointment the receptionist will call to check if they will still make it, if not, the appointment will be canceled and rescheduled for another time (will probably be scheduled as soon as possible but the interval of how long they have to wait for another appointment is determined by how serious their condition is), the patient can change the time of their appointment from their account on the website. If the patient say that they are still coming they are given 5 more minutes, if they don't show up after that their appointment will canceled and scheduled for another time, as mentioned before.

- **What if a Patient comes with no pre-scheduled appointment?**

  The receptionist will check if there are no appointments scheduled at the time of their arrival, if there is an empty slot the patient will be sent to the doctor's office, but if there was no empty slots the patient can check in with the receptionist to book an appointment for another time, or the patient can schedule one themselves using the clinic website, or wait at the clinic until there is a -same day add- appointment in the clinic's schedule.

- **What if an emergency case comes in?**

  According to the information we obtained from the clinic, most emergency cases occur after the weekends (most accidents happen on weekends) so a solution we gave to decrease delays in appointments after emergencies, was to design the appointment slots on the website in a way to free some time between appointments, by adding a -same day add- between every prescheduled appointment on the days after the weekend (Saturdays and Sundays) and less of those -same day- appointments on other days of the week, so when an emergency comes in there is a high probability that it will come in in the free time between appointments, even if it come when there's already a patient in the doctor office only one appointment will be delayed then, and the delay will not be long. We did our research and this method was proven to scientifically decrease delay in appointments.

- **What if doctor absent?**

  When a provider is sick or absent or there is inclement weather, an automated text message can be sent to all of the patient appointments scheduled for that day. This saves office staff a couple hours of phone calls and ensures patients arrive at their appointments on time, or if the doctor or provider will not come at all, it will save patients the drive and time to get to the clinic.

- **What if patient wants to cancel their appointment?**

  The automated reminder is a good way to remind patients of their appointment, 3 days before their deadline patients will be sent an automated SMS message that includes the time of their appointment and a warning that if they cancel their appointment after two days of the deadline they will be fined, and another message will be sent 2 days before the appointment to inform that they no longer can cancel and if they do they will be fined. And a final message 4 hours before appointment to remind them to come to the clinic on time.

  Late cancellations and no-shows are inevitable. But their negative effects can be mitigated, by sending out a mass automated text to all patients to notify them of availability and have them respond if they'd like to take the open appointment